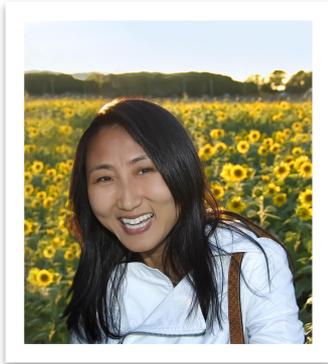


Accelerator Frontier 1: Beam Physics, Accelerator Education, Outreach & Diversity

AF1: Co-Conveners



Mei Bai (GSI/U. Bonn)



Zhirong Huang (SLAC/Stanford)



Steve Lund (MSU/USPAS)

Accelerator Frontier AF1 Lols organized under 4 tiers:

1. **A10** Tues Ultimate Beams
2. **A12** Tues Research Centers/Facilities
3. **64** Tues Computational & Machine Learning
4. **119** Here *with CommF* **Education, Outreach, Diversity**

Accelerator Education, Outreach, & Diversity (EOD)

Lols (13) Received in 3 (roughly) Groups

1. Education (8)

Lol File (Abbreviated)	Title	Submitting Author
1 AF1_Lund-023	US Particle Accelerator School Needs to Support Training Scientists and Engineers	Steve Lund
2 AF1_CommF_Jowett-027	The Joint Universities Accelerator School (JUAS)	John Jowett
3 AF1_Musumeci-037	Grand Challenges in Education and Outreach for accelerator science and technology	Pietro Musumeci
4 AF1_AF7_Barletta-099	University Research and Training of Accelerator Scientists and Engineers	William Barletta
5 AF1_Raubenheimer-121	Increasing the Pipeline of Graduate Students in Accelerator Physics	John Fox & Tor Raubenheimer
6 AF1_Swapan-174	Strategy for HEP Accelerator Workforce Training Coordination with BES, NP, and Industry	Swapan Chattopadhyay
7 AF1_Cook-186	Set For Success: How to Accelerate Early Career Accelerator Scientists	Nathan Cook
8 AF1_AF7_Patterson-227	At Risk: University-based Accelerator Science and Education	Ritchie Patterson

Education, Outreach, & Diversity Lols (13) Received

2. Outreach (5)

LoI File (Abbreviated)	Title	Submitting Author
9 AF1_Zimmermann-157	High-Level Facility Summaries and Articles Promoting Accelerator Science	Frank Zimmermann
3 AF1_Musumeci-037	Grand Challenges in Education and Outreach for accelerator science and technology	Pietro Musumeci
10 CommF_AF1_Malik-006	HEP Industry partnership and mobility	Sudhir Malik
11 CommF_AF1_Bruhweiler-066	Collaboration between industry and the HEP community	David Bruhwiler
12 CommF_AF1_Barzi3-065	Expanding Fermilab's international outreach through European Networks	Emanuela Barzi

2. Diversity (2)

LoI File (Abbreviated)	Title	Submitting Author
13 AF1_Bai-080	Workforce Diversity in the Field of Accelerators and Beam Physics	Mei Bai
3 AF1_Musumeci-037	Grand Challenges in Education and Outreach for accelerator science and technology	Pietro Musumeci

Next Step for those with AF1 EOD Interest

Proposal: 1st Follow-on SnowMass Online Workshop (Zoom) on Accelerator Education, Outreach & Diversity (EOD)

- Late October
- All AF1 Lol contributors + colleagues + key additions (CommF ?)
- **Input from CPM 119 (today) to help set agenda**
- Final Goal: Consensus Accelerator community recommendations for Snowmass report by July 2021

Today: AF1 EOD Topics in this CPM Breakout Meeting & Discussions with CommF

1. **Workforce Education/Training & Recruitment/Retention (10 + 3)**

Discussion Leaders:

Barletta (MIT)

Training & Education

Fox (Stanford U)

Recruitment & Retention

2. **Outreach & Diversity (10 + 3)**

Discussion Leaders:

Bai (GSI/U. Bonn)

Workforce & Diversity

Zimmermann (CERN)

Facility Summaries

Bruhweiler (RadiaSoft)

Outreach with Industry

1. Workforce Education/Training & Recruitment/Retention Barletta & Fox (10 + 3)

Training & Education

Snowmass AF1 LOI commentary

William A. Barletta

Dept. of Physics, MIT

Economics Faculty, University of Ljubljana



Themes in LOIs 1,2,4

❖ **USPAS needs:**

- OHEP must recognize USPAS is worth the money
- Don't ask for nickels
- No request for serious funds for high-production-value materials

❖ **Grand Challenges**

- Claimed need of 60 to 80 new PhDs is *not credible*
- Prefer education *for intellectual independence over traineeships for gigs*
- Boilerplate diversity message rather than *commitment from the DOE & labs to give their staff work-time and professional credit for outreach.*

❖ **Accelerate early career Scientists & Engineers**

- Be *open and honest* about real workforce needs and funding realities
- Opportunity to produce peer-reviewed publications is *essential but limited*; work critical to user facilities runs below high standards of high-impact journals
- *Expand the number of universities* with accelerator education programs
- Be serious about *institutional commitment* to work-life balance, mentoring, etc.
- *Reward staff* for teaching, outreach, mentoring, & knowledge transfer



Themes in 6 & 8

- ❖ Workforce Diversity
 - Writing was poor; *physicists need good copy editors*
 - Proposed actions: collect data, establish metrics, explore alternate career paths, & discuss more during 2021
 - Requires *broad discretion* in using DOE funds - *not frequently available*
 - *Work-life balance and other early career staff issues requires constant attention and action*
- ❖ Strategy for HEP Accelerator Workforce Training
 - Establishing a nationally coordinated, synergistic education and training program of the workforce is a critical – *BUT OHEP does not act that way*
 - The table of critical needs has *multiple serious errors*
 - Actually we need *3x more university physics & engineering departments* that offer a specialization in accelerator science and engineering
- ❖ Our particle physics colleagues would not accept our situation in silence
 - *Radical reform is needed*

Training, Education, Recruitment and Retention

Ideas for Discussion

J.D. Fox¹

W. Barletta²

¹Applied Physics, Stanford University

²MIT

Common Themes in LOIs 1,2,4,6,8

- US Particle Accelerator School Long Term needs - more support, travel funds for students
 - suffers from conversion to single-lab "program"
- Grand Challenges in Education and Outreach
 - Accelerator education at universities cannot grow without research funding and research activity at universities - project model doesn't support education
- Accelerate early career Scientists
 - Early career needs independent opportunities but mentoring by established experts - the strength of a University system
- Workforce Diversity in Field of Accelerators
 - proposal - collect data, establish metrics, discuss more
- Strategy for HEP Accelerator Workforce Training
 - Requires nationally coordinated and synergistic education support, but OHEP does not act this way. Difficulties with DOE project focus

Common Themes LOI proposals 5, 7 and 12

- Set For Success - early career researcher needs
 - Need to Integrate into larger community
 - Opportunities to Publish
 - Visibility
 - Learning
 - Funding
 - Leadership
- European Networks
 - European example - networks and funding via EC
 - Supported fellowships (e.g. Marie Curie) and Exchange (RISE) and Training (ITN) networks
 - Can the US participate, emulate these important programs for young scientists
- Increasing Graduate Student Pipeline in Accelerator Physics
 - Need to start at Undergrad level, field is invisible
 - Proposal for Colloquia series for diverse undergrad institutions
 - Increases visibility to students as well as undergrad faculty
 - Diversity and recruiting from small high quality institutions
 - only makes sense if there are research opportunities for Ph.D. students in the field

2. Outreach & Diversity: Bai, Zimmermann, Bruhwiler (10+3)



SnowMass2021

Work force and Diversity

SNOWMASS21-AF1_AF0-080: M. Bai(GSI), K. Harkay(ANL), Z. Huang(SLAC), S. Lund(MSU)
V. Shiltsev(FNAL), R. Zwaska (FNAL)

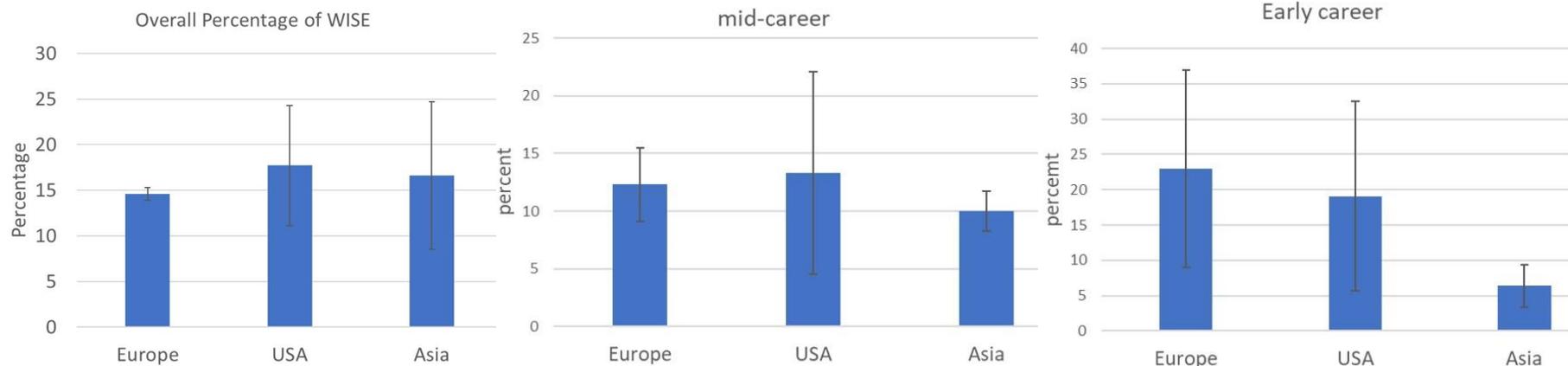
SNOWMASS21-AF1_AF0_Pietro_Musumeci-037: Pietro Musumeci on behalf of DPB

For AF1_EOD session at CPM Oct. 7, 2020

In summary

SnowMass2021

- There continues to be a strong need for accelerator science and technology workforce development due to steady demands from National Laboratories and increased demands from industry
 - ~ 4500 accelerator scientists and engineers work in more than 50 countries. Several thousand people, including nearly 1400 in Europe and approximately 400 in the US, receive some training in accelerator and beam physics annually
 - US produces 15 ~20 doctoral accelerator scientists per year, but the estimated need at labs and in industry is four times that number
- Despite of the continuous efforts in increasing under represented minorities and improving gender balance. Progress has been stubbornly slow, in large part due to insufficient pools of prospective students. We



Proposes

SnowMass2021

- Identify a standard protocol for keep tracking of diversity statistics across all accelerator facilities to properly reflect the ongoing inequality issues during various career stages. Statistics in sub-fields such as physics vs engineering can also be very helpful
 - Most institutions track gender statistics. But, not all track the stage of career which is also differently defined
 - Not easy to get statistics of under presented minorities, especially outside USA
- Accelerator Frontier, jointly with the Community Engagement Frontier, to organize broad discussion of the discussion of these issues during the Snowmass'2021 HEP community planning process
 - See this joint session
- Engage the community to identify possible activities with effective measurable outcomes
 - ❖ Enhanced outreach to primary school students to advertise opportunities in accelerator science and technology. Schools with higher under represented minority percentages could be targeted for greater impact
 - ❖ Impactful opportunities could be provided for under represented minorities with just a small amount of earmarked funding. For example, a complete scholarship including travel funds to USPAS could be reserved for each session for an underrepresented minority student. Full funding for undergraduate summer internship positions at a national laboratory could be similarly made available
 - ❖ Explore creating faculty lines and research programs at HBCUs and MSIs that include accelerator physics, and establish relationships with laboratories to create a talent pipeline
- Explore alterations to career paths that reduce the uncertainty and poverty of early-stage positions to enable those with less privileged back-grounds and greater family obligations to proceed within the field of accelerators

High-Level Facility Summaries and Articles Promoting Accelerator Science

M. Blaskiewicz (BNL), J. Delayen (ODU & JLab), W. Fischer (BNL), M. Hogan (SLAC), I. Hofmann (GSI & TU Darmstadt), Z. Huang (SLAC), C. Joshi (UCLA), J. Jowett (GSI & ESI), M. Litos (U Colorado Boulder), S. Lund (MSU & USPAS), S. Nagaitsev (FNAL), Q. Qin (IHEP), T. Raubenheimer (SLAC), D. Schulte (CERN), T. Sen (FNAL), V. Shiltsev (FNAL), A. Wolski (U Liverpool), V. Yakimenko (SLAC), F. Zimmermann (CERN)

LOI #157:

1. **Formulation of high-level facility summaries** to serve as **high-profile citeable publications** for the accelerator field
2. General community effort towards **enhancing the popular and academic appearance of accelerator physics.**

Facility summaries: PRAB special collection

Initiative of PRAB Editorial Board, strongly supported by APS DPB. In 2019 Physical Review Accelerators and Beams announced special collection of articles reviewing user-facility accelerators [1]. **Editor:** Michael Blaskiewicz.

Announcement channels: mailing lists APS-DPB, EPS-AG, and EPS-HEPP

Several purposes:

- 1) Provide **up-to-date references for accelerator community & users,**
- 2) **Allow users an easy way to give credit** to the accelerator team, which enabled the experiment to occur,
- 3) **Increase the PRAB journal Impact Factor,**
- 4) **Improve the Accelerator Science visibility**

Each facility can produce a document describing their machine and relevant systems. Regularly updated articles for upgrades and operational improvements: **fresh up-to-date references.**

So far, only one review published, on the UK CLARA facility [2].

At Snowmass 2021 want to advertise this initiative, alert users, and to convey our expectation and aspiration to the US facilities

a parallel effort

to raise visibility and academic standing of
accelerator community:

promotion of **accelerator-related articles in
prestigious or widely-read journals** like

**Physical Review Letters, Physical Review X,
Nature, Scientific American, & Physics Today**

References

1. <https://journals.aps.org/prab/speced/USER-ACCEL>
2. <https://journals.aps.org/prab/pdf/10.1103/PhysRevAccelBeams.23.044801>

Accelerator Outreach with Industry (2 LOIs)

- **HEP Industry partnership and mobility**

Y. Chen, S. Malik, J. Hogan, A. Karadzhinova-Ferrer and A. El Zant

- *Many HEP personnel find their way to careers in industry*
- *HEP institutions should partner with industry to facilitate transitions*
- *Internship programs should be scaled up for HEP postdocs*

- **Collaboration between industry and the HEP community**

D. Bruhwiler, B. Hidding, R. O'Bara, S. Baturin, C.-K. Ng, C.S. Park, P. Piot, A. Sauers, J.-L. Vay, et al.

- *The HEP community should enable industry to contribute to software development*
- *This will enable labs and universities to focus on core competencies*
- *Creates a more diverse set of possibilities with career pipelines*